Fixed and properly imbedded, the cells retain their normal condition and position; the intercellular spaces are just as they were in the living plant.

The embryos of other plants afford quite as distinctive structural characters and often as interesting functional adaptations.

The correct interpretation of tissue modifications in plants has led to the conclusion that plant diseases may be caused by improper conditions of moisture, etc. Dropsy in plants has been caused by too great activity in the root-system of the plant, and thereby unbalancing the equilibrium between absorption and transpiration. This disease was first discovered by a careful examination of the structural details, and the fact that the disease was so discovered leads to the opinion that much light may be thrown upon the diagnosis and cure of plant diseases by a careful study of the minute structure of the plant.

NATIONAL PARK PROTECTION.

BY GEO. BIRD GRINNELL.

THE recent slaughter of twenty or more of the National Park buffalo has excited widespread comment and calls attention anew to the fact that, although the Yellowstone Park was established twenty-two years ago last March, no law for its protection has ever been enacted.

The organic act by which the Park was set aside says that the Secretary of the Interior shall make rules and regulations for its protection and the preservation of its natural wonders, but nothing in this act nor in any other provides any form of government, gives jurisdiction to any court, appoints any law officers or defines and fixes penalties for any crimes or misdemeanors committed within the boundaries of the reservation.

There are now pending before Congress—in the House of Representatives and in the Senate as well—several bills which provide for the cutting off from the area of the Park about 1,200,000 acres of land, largely forest covered, and one or two which contain some needed government and police provisions. It is of the utmost importance that one of these last named bills should be passed. No matter how efficient and energetic the commander and his troops, to whom the care of the Park has been given, it is impossible for him efficiently to protect it so long as no punishment awaits the man who violates the regulations established by the Secretary—shoots down the buffalo or fires the forests. As things exist to-day no such punishment can be meted out. Government scouts may capture a poacher red-handed, having just slain some of America's largest wild animals, but it is certain that soon after the prisoner has been brought to the guard house, he will be set free, because no law takes cognizance of his crime and provides that he shall be given a trial and punished if found guilty. The Yellowstone Park has been set apart from the states in which it lies, and put under the authority of the Secretary of the Interior. The laws of those states, therefore, do not apply to crimes committed within its borders, and Congress has given the Secretary of the Interior no authority to punish crime.

No class of men comprehend better than the readers of *Science* the importance of preserving the Yellowstone Park and all it contains as nearly as possible in a state of nature. Nor is there any class among our population who can exercise more influence toward inducing Congress to pass the much needed laws. It is earnestly to be hoped that each reader of *Science* will do his part toward bringing influence to bear on Congressmen and Senators, so that a proper police bill may be passed for the Park.

Some of the objections to the passage of the segregation bill are that such segregation would establish a very bad precedent, since if one corner can be cut off to-day another may be cut off to-morrow, and by continual whittling the area of the Park may finally be reduced to nothing. Segregation by reducing the area of the Park brings skin hunters nearer to the herds of wild game and to the forests, and increases the danger to both. Segregation also absolutely destroys large herds of wild game and considerable areas of forests at present existing in the country proposed to be segregated. Segregation reduces the area of the National Park by nearly 1,200,000 acres, restoring to the public domain land which is utterly valueless for purposes of settlement. It is high, rough, mountain land, unfit for agriculture or stock range, overgrown with timber which is at present too far from a market to be of vulue, and probably without any mineral deposits that are worth working. This land will be vastly more useful as a forest reserve than it can be for any other purpose.

THE SEMBLING OF A LARGE NATIVE MOTH, *TELEA POLYPHEMUS*.

BY H. GARMAN, LEXINGTON, KY.

THE collection of males of our larger Bombycid moths has sometimes been practised by confining newly matured females so that the males attracted could be secured, but I am not aware that it has been made a matter of careful observation and record, or that the source of the attracting secretion has been made out. I have often secured a limited number of male *T. polyphemus*, and of *Platysamia cecropia*, by this method, but a recent experience is, for myself, out of the ordinary, and may be worth reporting.

In the latter part of July, 1893, a fine female *T. polyphemus* emerged in one of my breeding cages. She came from her cocoon in the afternoon, and by night her wings were pretty well expanded. I thought when I went home at five o'clock that her wings were not sufficiently firm for a good cabinet specimen, and so she remained in the cage till next day. In the evening of the following day cage and moth were taken to my home, and mosquito-bar being tacked over the front of the cage the latter was placed in the open window of my bedroom. In the night I was awakened by the fluttering of wings against the window and curtains, and getting up secured the two first males that had appeared. It was then just 1.30 A. M. From this time till daylight the males continued to come, sometimes two or three arriving about the same time, but oftener one at a time. All that appeared were captured, and in the morning I found I had twenty males, most of them nearly or quite new in appearance.

The next night the same story was repeated, the first moths appearing at about half-past one, and the rest scattering along between this and morning. This night I secured twenty-three males.

The third day was rather cool, and the night following was cool and breezy. The female had now laid most of her eggs. No males appeared. I thought no more would come, but concluded to leave the cage in the window a few nights longer.

The fourth night five males appeared, and on the sixth, four were secured. In the former case the first moth appeared at fifteen minutes of one, and in the latter at two o'clock.

On the sixth night no males were secured, and the

female having placed all her eggs on the sides of the cage, it was decided to terminate the experiment.

As a result I had fifty-two males, all attracted to a single female, in a locality in which the species is not more than ordinarily common. All arrived in the latter half of the night, indicating either that the sense of smell in the males is extraordinarily acute, and that they travel long distances to find the female, or else that it is their habit to be abroad only after midnight. I have no very reliable data upon which to base a conclusion on these points. The scent glands of the female are to be looked for on the under side of the abdomen, where such organs have already been discovered in certain smaller members of the same family of moths. The male organs of smell are doubtless the conspicuously branched antennæ.

IS GRANITE EVER METAMORPHIC?

BY C. CALLAWAY, D.SC., F.G.S., WELLINGTON, SALOP, ENGLAND.

It is not so many years since it was commonly believed that granite was frequently of metamorphic origin. Numerous cases were quoted of a gradual passage between sedimentary strata and granite; and, as it was held to be incredible that a sediment could be produced from granite, it was inferred that the granite was an altered form of the sediment. The present writer shared in the popular belief, and in several papers written on the more ancient of the Archæan rocks of Great Britain, he assumed that the granitic masses called "Dimetian" and "Malvernian" were metamorphosed stratified rocks. But scepticism soon began to creep in. Case after case broke down on examination, until, within the area of the British Islands, he was unable to find a genuine case of a passage between a sediment and a granite. A few examples will here be given.

In North Wales, several cases were alleged. At Twt Hill, in the town of Caernarvon, granite was said to pass into a quartzose conglomerate. The gradations did indeed appear to be perfect in the field, but the microscope proved that the naked eye was not a reliable guide. It was shown that the granite passed into the con-glomerate through the intermediate form of arkose, and even the authors of the metamorphic theory voluntarily surrendered it. A second locality was in central Anglesey. Here a band of granite strikes across the island, trending in the same direction as the adjacent sedimentary and schistose rocks. On one side of it lies hälleflinta, passing into schist. The granite has been described as "Dimetian," and the hälleflinta as a younger formation called "Arvonian." The writer has given prolonged attention to these rocks, and has discovered localities where the granite is seen to send veins into the hälleflinta. The granite must, therefore, be of less antiquity than the hälleflinta, and of eruptive origin. In other parts of Anglesey, certain sediments of Ordovician age have been supposed to be here and there converted into granite; but the most recent investigation of these rocks does not confirm this hypothesis.

In England the facts are similar. The schistose and gneissic rocks of the Malvern Hills have been described as metamorphic Cambrian strata. At a later period they were referred to the Laurentian system, being still regarded as altered sediments. The present writer has been studying these rocks for several years, and has described them as exclusively of igneous origin. The oldest varieties are diorites, and into these there have been intruded granites, felsites, dolerites, and other diorites. Subsequently to consolidation, these masses have been subjected to enormous pressures, which have produced shear-zones, in which the eruptive rocks have been converted into various gneisses and schists. A very good summary of the writer's papers on these rocks has recently (February 9, 1894) been given in *Science* by Prof. J. W. Redway. Some of the conclusions are still under discussion; but the eruptive origin of the diorites and granites has been admitted by all those who have reviewed the work in the field.

The Hebridean gneisses of Scotland have recently been examined by the Geological Survey of Great Britain. The conclusion of the Director-General (Sir A. Geikie) is that "after a most careful search in these rocks, not a vestige have we yet found of any unquestionable sedimentary material." The writer has given some attention to alleged examples of metamorphic granite in Ireland. In County Donegal a great mass of granite rises amidst quartzites, limestones, and schists, and it has been affirmed that there is a gradual passage between the schists and the granite. The writer examined the junction of the two kinds of rock on both sides of the granite mass, and found the clearest proof of igneous intrusion. At some points the granite veins are seen to run into schists, and to branch in the ordinary manner. Elsewhere the granite is in contact with limestone, and has altered it, producing in it an abundance of garnets as well as some lime-augites.

In western Galway there is another alleged case of the passage of sedimentary rocks into granite. These, also, the present writer has examined. He has found clear evidence of breaks between the sediments and the schists into which they were supposed to pass. He has also ascertained that the "metamorphosed conglomerates" adduced in proof of the sedimentary character of the Galway schists are mixtures of schist, granite and diorite, or of two of them. A foliated structure sometimes appearing in the granite was seen to be due to regional pressure, and not to sedimentation.

A third case, occurring south of Wexford, was also investigated. The writer came to the conclusion that the granite of the Carnsore district nowhere passed into crystalline schists, and that the schists were sharply separated from the sedimentaries by faults. It is possible that some of the schists have been formed from igneous rocks, but, if so, they belong to a different period from the Carnsore granite, which shows no signs of foliation.

In adducing these examples the writer infers no conclusion wider than the facts. He does not deny that there may be such a thing as metamorphic granite; he merely points out that certain alleged proofs have broken down on examination. Nevertheless, the results of the most recent work by other geologists have tended to confirm his investigations, and to suggest extreme caution in accepting other supposed cases of a passage between granite and stratified rocks.

One cause of error in the past has been the assumption that a banded structure was always the result of sedimentation. This view is now exploded, and need not be dwelt upon here. It has recently been shown that even rocks with all the appearance of a banded grit may be of igneous origin. The writer has described a very interesting case of this kind in the Malvern Hills. A granitoid diorite is crushed and decomposed. The hornblende passes into chlorite and iron oxide, which are interlaminated with finely comminuted feldspar. Both in the field and under the microscope the rock has the appearance of a true sediment. Yet it may be traced without a break into the diorite on one side and into a mica-gneiss on the other. In the old days this grit would probably have been regarded as a conclusive proof that the whole series was of sedimentary origin.